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# Science & Technology

## USSR: Chemistry

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UDC 543.42

**Atomic Absorption Determination of Lead, Tin, Bismuth, and Antimony Impurities in High-Alloy, Tungsten- and Niobium-Containing Steel Using Sample Electrodisolution**

18410128b Moscow *ZHURNAL ANALITICHESKOY KHIMII* in Russian Vol 44, No 1, Jan 89 (manuscript received 13 Oct 87) pp 68-72

[Article by I. P. Kharlamov, V. I. Lebedev, and V. Yu. Persits, Machine Building Technology Scientific Production Association, Moscow]

[Abstract] Atomic absorption spectroscopy with electrothermal sample dissolution was used to measure lead, tin, bismuth, and antimony in high-alloy tungsten- and niobium-containing steel. Nitric acid was used for sample dissolution with a mixture of tartaric acid and ammonium citrate to keep the tungsten and niobium in solution. The complexing agents permitted complete sample dissolution and high-sensitivity analysis while having no effect on standard calibration lines. Thin shavings of the steel sample (0.5 g) were dissolved by using 1.5-2.0 amps for 1.5-2 hours. The accuracy and reproducibility of the method were verified by using standard steels. A comparison of results calculated by using standard calibration lines, standard addition, and authentic recovery showed good agreement. Four samples of industrial steel were analyzed by the method developed, with three of the samples giving similar results. The data indicate that the method developed gives an accurate determination of lead, tin, bismuth, and antimony in high-alloy tungsten- and niobium-containing steel, with a limit of detection of  $10^{-4}$ - $10^{-5}\%$ . Figures 2; references 7: 6 Russian, 1 Western.

UDC 543.544:543.8

**Identification of Nitrogen-Containing Organosilicon Compounds in Gas Chromatography**

18410128d Moscow *ZHURNAL ANALITICHESKOY KHIMII* in Russian Vol 44, No 1, Jan 89 (manuscript received 7 Sep 87) pp 105-108

[Article by T. I. Rybkina, E. A. Kirichenko, and V. A. Kochetov, Novomoskovskiy Branch, Moscow Chemical Technology Institute imeni D. I. Mendeleyev]

[Abstract] The gas chromatographic behavior of various aminosilanes, aminosiloxanes, linear silazanes, cyclosilazanes, and substituted cyclosilazanes was studied on four stationary phases: Apiezon L, SE-30, Carbowax 20M, and XE-60. Carbowax 20M was the most selective phase, followed by XE-60 and SE-30, with Apiezon L being the least selective. A series of correlation equations were developed that connect the Kovats indices of various classes of nitrogen-containing organosilyl compounds with their physicochemical characteristics. Taft inductive constants were calculated for the contributions of triorganosilyl or triorganosilylmethyl groups to the

retention behavior. The coefficients obtained demonstrate the high sensitivity and selectivity of polar liquid stationary phases to changes in aminosilane structure. The retention index may be calculated from the molecular mass, the sum of the inductive constants for substituents on silicon, or the number of silicon atoms in the molecule. A comparison of the experimental values for the retention index with those calculated from the incremental contributions of the structural groups gave differences of no greater than four units. The equations obtained make it possible to identify the compounds considered in the analysis of multicomponent mixtures by gas chromatography. References 9 (Russian).

UDC 543.544.45:615.779.9:542.8.9

**Gas Chromatographic Vapor-Phase Analysis of Residual Solvents in Antibiotics**

18410128e Moscow *ZHURNAL ANALITICHESKOY KHIMII* in Russian Vol 44, No 1, Jan 89 (manuscript received 22 Jun 87) pp 109-114

[Article by I. A. Tsibulskaya, A. G. Vitenberg, and B. V. Ioffe, Leningrad State University]

[Abstract] The accuracy achievable by solid or solution vapor-phase gas chromatographic methods in determining residual solvents in antibiotics was investigated, and optimal analytical parameters were determined. A Separon-BD column at 170°C and an ethanol internal standard were used. Samples were thermostated at 60°C for 20 minutes before the introduction of vapor-phase gases into the column. Analysis of aqueous solutions of tetracycline showed the presence of methanol and 2-propanol. Acetone, 1-propanol, 1-butanol, and butyl acetate were similarly detected in sodium fusidate and 1-butanol and butyl acetate in penicillin. Crystalline potassium bisulfate was used to prevent hydrolysis in analyzing tetracycline; it also increased the method's sensitivity. Samples of tetracycline from which residual solvents were absent were spiked with known amounts of methanol and 2-propanol and analyzed by the absolute calibration and internal standard methods. Both methods had similar results and excellent recoveries. Standard addition gave errors up to 30%. Direct gas extraction of residual solvents from tetracycline or instatin powder was not successful in that equilibrium was not achieved even after 12 hours at 90°C (a 6-mg sample). Nonequilibrium methods gave nonreproducible results. Solution vapor-phase gas chromatography was used to analyze five samples of industrial tetracycline, five of fusidate, and two of penicillin with relative standard deviations of not more than 0.04%. In the 0.010-0.3 mass percent range, the error of measurement was not more than 8.3%. The detection limits were 0.00003 mass percent for methanol and 0.0002 mass percent for 2-propanol. Figures 1; references 13: 7 Russian, 6 Western.

UDC 542.91:547.751:547.314

**3-Indolthioles in Reactions With Acetylenes**  
18410139e Moscow IZVESTIYA AKADEMII NAUK  
SSSR: SERIYA KHIMICHESKAYA in Russian  
No 2, Feb 89 (manuscript received  
23 Sep 87) pp 416-419

[Article by B. V. Trzhtinskaya, N. D. Abramova, L. F. Teterina, L. V. Andriyankova, and A. V. Afonin, Organic Chemistry Institute, Irkutsk]

[Abstract] Indole derivatives, and especially 3-indolthiol, are biologically active compounds, and the present work was undertaken to both increase their number and study the nature of their nucleophilic addition to acetylenes. In a previous work it was demonstrated that in this reaction both mono- and divinyl monomers are formed, depending on the reaction conditions. If the methyl group is introduced at the 2-position of the indole ring, the reactivity of 2-methyl-3-indolthiol is somewhat reduced. Greater heat is required for the formation of both 2-methyl-3-vinylthio- and 1-vinyl-2-methyl-3-vinylthioindole than for the formation of the corresponding vinyl derivatives of 3-indolthiol. This is apparently due to an electron-donor effect of the methyl group that strengthens the proton bonds to the N and S heteroatoms. Introduction of an electron-donor group in the acetylene molecule activates the triple bond in reactions with 3-indolthiol and 2-methyl-3-indolthiol. In the present work S-mono- and N,S-divinyl derivatives were prepared by the addition of 2-methyl-3-indolthiol to acetylene. Activated acetylene reacts with 3-indolthiols only at the sulfur atom. 3-Indolthiol reacts stereoselectively with phenylacetylene to form the cis-isomers. It reacts with cyanoacetylenes to form mixtures of Z- and E-isomers. References 6: 5 Russian, 1 Western.

UDC 536.631+546.27'662

**Heat Capacity of GdB<sub>4</sub> Single Crystals at Low Temperatures**  
18410140g Moscow ZHURNAL FIZICHESKOY  
KHIMII in Russian Vol 63 No 2, Feb 89 (manuscript  
received 1 Feb 88) pp 520-521

[Article by A. S. Bolgar, V. B. Muratov, V. I. Lazorenko, and A. V. Blinder, Problems of Material Science Institute, Kiev]

[Abstract] Gadolinium tetraboride has a high melting point, congruent melting and evaporation patterns under a vacuum, and satisfactory emission properties, thus

making it a candidate for use as an emission material in electronics along with widely used lanthanum hexaboride. However, information on the thermodynamic properties of this material is sparse. In the present work the heat capacities of freshly prepared gadolinium tetraboride were determined at temperatures ranging from 66.52 K to 290.5 K and rounded off at 10-degree intervals to 290 and 298.15 K. Enthalpy, entropy, and Gibb's energy values were determined. Comparison of heat capacities for the tetra- and hexaborides shows that they are close and that a systematic separation point is lacking. References 5: 4 Russian, 1 Western.

UDC 541.183.123

**Physicochemical Properties of Polypropylene-Based Fibrous Ionite FIBAN**  
18410145c Minsk VESTSI AKADEMII NAVUK BSSR:  
SERIYA KHIMICHNYKH NAVUK in Russian  
No 1, Jan-Mar 89 (manuscript received  
7 Jul 88) pp 69-74

[Article by G. V. Medyak, A. A. Shunkevich, and V. S. Soldatov, Physical Organic Chemistry Institute, Minsk]

[Abstract] In a previous work it was demonstrated that fibrous ionites that containing sulfo (FIBAN K-1) or ammonium groups (FIBAN A-1) and that are capable of strong dissociation can be made by grafting polystyrene or a styrene-divinylbenzene copolymer to a polypropylene matrix. Such ionites have a high exchange capacity (3-4 mg eqv/g) and are both chemically and mechanically stable. In the present work a study was made of the physical and mechanical properties of similar ionites prepared by grafting styrene-divinylbenzene copolymer to polypropylene and by adding various functional groups (chloromethyl, strong and weak bases, and sulfonic acid) to the fiber after grafting. The results show that these ionites could be mono- or polyfunctional, depending on the synthesis conditions and the selected modifier added. Despite a slight drop in strength and elasticity following synthesis, the fibers still retain enough mechanical strength for recycling purposes. They may also be fabricated in perforated sheet form instead of a woven fabric for filtration purposes. Figures 3; references 13 (Russian).

UDC 541.128:541.64:547.313.2

**Studies on Catalytic Properties of Pentacil-Containing Compositions in Hydrocarbon Conversion Reactions. Report 1. Oligomerization and Aromatization of Ethylene Over Pentacil-Aluminum Oxide System**

18410139b Moscow IZVESTIYA AKADEMII NAUK  
SSSR: SERIYA KHIMICHESKAYA in Russian  
No 2, Feb 89 (manuscript received  
11 Nov 87) pp 254-258

[Article by O. V. Bragin, V. I. Yakerson, T. V. Vasina, S. A. Isayev, L. I. Lafer, and V. D. Nissenbaum, Organic Chemistry Institute imeni N. D. Zelinskiy, Moscow]

[Abstract] High-silicon zeolites of the pentacil type have high catalytic activity in the conversion of lower olefins to form aliphatic (at 200-300°C) oligomers or aromatic hydrocarbons (at higher temperatures). These catalysts frequently incorporate alumina, whose function is not limited solely to that of a binder. In the present work a study was made of the properties of H-pentacil-alumina compositions in reactions of ethylene oligomerization and aromatization, and the results were compared with data obtained by IR-spectra and thermal analysis. The system has high activity and selectivity in aromatization reactions at 350-500°C and a marked increase in activity at 0.5-10% H-pentacil in alumina. The increase is only moderate, however, when alumina is added to H-pentacil. A correlation exists between the activity and the number of strong Brønsted and Lewis sites, and it was concluded that the aromatization reaction requires both types of reaction sites. No additivity in hydrophilic properties was observed in the system as compared with the pure components. This effect apparently reflects a change in organophilic properties, having a positive effect on the activity and selectivity of the process. Figures 3; references 16: 4 Russian, 12 Western.

UDC 543.422.4:541.128

**IR-Spectra of Catalysts and Adsorbed Molecules. Report 37. Catalytic Composition Pentacil-Aluminum Oxide**

18410139c Moscow IZVESTIYA AKADEMII NAUK  
SSSR: SERIYA KHIMICHESKAYA in Russian  
No 2, Feb 89 (manuscript received  
11 Nov 87) pp 259-264

[Article by L. I. Lafer, Zh. L. Dykh, T. V. Vasina, O. V. Bragin, and V. I. Yakerson, Organic Chemistry Institute imeni N. D. Zelinskiy, Moscow]

[Abstract] The discovery of a new class of high-silicon zeolites having molecular sieve activity has prompted the study of their catalytic activity in many reactions. In the presence of several domestic alumina-silica zeolites of the pentacil type (ZMS analogues), methanol, dimethyl ether, and ethylene are converted to aliphatic C<sub>2</sub>-C<sub>11</sub> and aromatic C<sub>6</sub>-C<sub>12</sub> hydrocarbons. During fabrication,

the zeolite is introduced into a metal oxide (alumina) matrix to increase its mechanical strength. This matrix is normally considered to be an inert component of the catalyst. However, it has been reported that high-silicon zeolites become activated in the presence of aluminum oxide as a result of aluminum transfer to the zeolite carcass, which gives rise to new acidic sites. In the present work an IR-spectroscopic study of the pentacil-aluminum oxide catalyst system shows that zeolite crystallinity is retained over a wide range of compositions and that there is no aluminum transfer from the oxide to the carcass. It is possible to determine the concentration of the zeolite component on the basis of spectral data. The catalytic composition HZSM-γ-alumina contains both B- and L-sites, the ratio of one to the other being a function of the composition. Extinction coefficients for pyridine absorption bands—adsorption at the B- and L-sites—were determined, and the concentration of acidic sites for each component of the composition was calculated. Figures 5; references 20: 10 Russian, 10 Western.

UDC 541.128

**Dispersion of Platinum and Valence State of Chromium in Pt+Re+Cr/γ-Al<sub>2</sub>O<sub>3</sub> Catalysts for n-Heptane Dehydrocyclization**

18410145a Minsk VESTSI AKADEMII NAVUK BSSR:  
SERIYA KHIMICHNYKH NAVUK in Russian  
No 1, Jan-Mar 89 (manuscript received  
6 Jul 87) pp 9-14

[Article by Ye. A. Skrigan, G. M. Senkov, L. A. Kupcha, M. F. Gorbatshevich, and N. S. Kozlov, Physical Organic Chemistry Institute, Minsk]

[Abstract] The present work is a continuation of a study on the dispersion of platinum and the valency states of chromium in alumina-platinum-rhenium-chromium catalysts. The dispersion of platinum in an alumina-platinum catalyst can play an important part in its activity in hydrocarbon conversion reactions, particularly n-heptane dehydrocyclization, noting that platinum has several types of reaction sites during stabilization at different locations on the γ-alumina surface. The number of active sites of any particular type depends both on the conditions under which the catalyst was prepared and on the dispersion of the metallic component. In the present work it was demonstrated that the dispersion of the metallic phase in platinum-rhenium-chromium catalysts also depends both on the method of preparation and on the chromium content. A relationship exists between the rate and degree of chromium reduction in alumina-platinum-rhenium-chromium catalysts and the order in which the components are added to the catalyst and its thermal activation conditions. Catalysis of chromium reduction with platinum does not depend on the method of catalyst preparation, while catalysis with rhenium does. References 12 (Russian).

UDC 541.128.13

**Catalytic Oxidation of Oxyhydrogen Mixture in Saturated Steam at Temperatures to 220°C**

18410145b Minsk VESTSI AKADEMII NAVUK BSSR:  
SERIYA KHIMICHNYKH NAVUK in Russian  
No 1, Jan-Mar 89 (manuscript received  
22 Jul 88) pp 24-27

[Article by V. A. Shnyp, G. I. Novikov, V. V. Poplavskiy,  
V. P. Glybin, and V. G. Vilivetskiy, Belorussian Technological Institute imeni S. M. Kirov]

[Abstract] Catalytic oxidation of the oxyhydrogen mixture resulting from boiling water nuclear reactors is one possible way to provide safety. Nickel and other metal oxides on graphite carriers and platinum grids are not

sufficiently catalytically active at saturated steam pressures corresponding to temperatures of 190-220 °C. Also, nickel oxide tends to oxidize, and graphite converts to CO<sub>2</sub> under these conditions. Since recombination of hydrogen and oxygen results in a net volume reduction (1.5 moles of oxyhydrogen gas mixture forms 1 mole of steam), an effectively functioning catalyst may be used as a volumetric indicator of the degree of conversion. An experimental procedure and equipment were described in a previous work. In the present work a catalyst made of S-120 stainless steel gauze containing 0.15% by weight of palladium applied to the surface according to GOST 9.305-84 was used to obtain kinetic parameters of the process that could be used to compute the catalyst surface required for the continuous-type reactor that is needed to provide a given degree of conversion under stationary conditions. Figure 1; references 6 (Russian).

UDC 541.182.6:546.571'141-171

**Preparation of Stable Ultradispersed Colloid in Water/Oil Microemulsions**

18410139h Moscow IZVESTIYA AKADEMII NAUK  
SSSR: SERIYA KHIMICHESKAYA in Russian  
No 2, Feb 89 (manuscript received  
25 May 88) pp 479-480

[Article by V. A. Nadtochenko, V. F. Razumov, and M. V. Alfimov, Chemical Physics Institute, Chernogolovka]

[Abstract] Extremely fine silver halide particles on the order of 10 angstroms play an important part in microcrystal growth initiation in silver halide photographic emulsions and in the formation of their light-sensitive properties. However, no one has yet been able to stabilize such fine silver halide microparticles and study their

physicochemical properties. In the present work sufficiently stable ultradispersed silver bromide colloids were prepared by combining two microemulsions, one containing silver nitrate and the other potassium bromide in the aqueous phase. The emulsions consisted of octane/Triton X-100/butanol/water (0.69/0.069/0.237/0.038), and converted micelles (octane/AOT/water). By varying the silver nitrate and potassium bromide concentrations in the aqueous phase it was possible to change the degree of dispersion in the colloid. Several seconds after the emulsions were combined, the silver bromide absorption spectra observed coincided qualitatively with the spectra from a dusted layer of silver bromide. Under the experimental conditions, the mean number of silver ions on a micelle (microemulsion particle) varied from 6 to 20. The silver bromide colloid remained stable for several hours. The described method makes it possible to study the spectral characteristics and other physicochemical properties of ultrafine silver halide particles. Figure 1; references 3 (Western).



UDC 543.544.25

**Gas Chromatographic Determination of Microimpurities in Products of Catalytic Purification and Recombustion of Industrial Effluents**

18410128c Moscow *ZHURNAL ANALITICHESKOY KHIMII* in Russian Vol 44, No 1, Jan 89 (manuscript received 4 Sep 87) pp 97-104

[Article by M. Ye. Shalayeva, V. I. Zheyvot, V. V. Malakhov, N. V. Kovaleva, S. A. Venyaminov, and A. A. Vlasov, Institute of Catalysis, Siberian Division, USSR Academy of Sciences]

[Abstract] Graphitized thermal carbon modified with a small amount of polyethylene glycol 20,000 was used as a column packing for the gas chromatographic analysis of industrial effluent. A special device was developed for exponential dilution of the sample. The specific retention volumes of 37 volatile organic compounds were measured, and they ranged from 0.3 mL/g for methanol and diethyl ether to 84.6 mL/g for nitrobenzene. Differential molar changes in intrinsic energy were determined for 23 of the substances. Analysis of plasticizer factory effluent demonstrated the presence of not fewer than 15 components. After catalytic purification and recombustion, di-n-butyl ether was the main component remaining. Calibration lines were obtained for di-n-butyl ether, ethanol, n-hexanol, and 2-ethylhexanol. Exponential dilution was used to prepare standards of n-hexane, chloroform, methylene chloride, and 1,1-dichloroethane. For methylene chloride, linearity was observed from 7.6 to 4,000 mg/m<sup>3</sup>. Heating the sample vessel during dilution extended the linear range. Figures 4; references 20: 8 Russian, 12 Western.

UDC 628.543:665.6.013+628.179

**Technology for Self-Contained Water System of Omsknefteorgsintez Production Association**

18410138i Moscow *KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL* in Russian No 2, Feb 89 pp 36-40

[Article by K. Z. Sayfutdinov, Bashkir Petroleum Refinery SRI]

[Abstract] The closing or self-containment of industrial water management systems is one of the most important tasks in environmental protection. The problem of organizing an effluent-free oil refinery having a self-contained recirculating water supply system (SOV) was first developed at the Bashkir Petroleum Refinery SRI. Since the start of the 1970's, water consumption has been significantly reduced at the refinery by separating salt-containing effluent and recycling biochemically treated effluent. Effluent from the Omsknefteorgsintez Production Association is collected at a joint biological treatment facility at a synthetic rubber plant designated for treating the major portion of effluent from Omsk city

and its northwest industrial sector. This facility is overloaded. With the diversion of part of the Irtysh river water into the Irtysh-Karaganda canal and the continuing damming up of Irtysh water by the industrial region, the need arose for a marked cut-back in consumption of river water. The river also supports a fishing industry. In 1984 the water management system of the production association was inspected to develop recommendations for a self-contained water system, and the plan for this system is presented. Figure 1; references 8 (Russian).

UDC 631.811.94:631.95

**Features of Heavy Metal Distribution in Insects of Roadside Agrocenoses**

18410144d Moscow *AGROKHIMIYA* in Russian No 2, Feb 89 (manuscript received 6 Jan 89) pp 84-90

[Article by R. O. Butovskiy, Environmental Protection and Preserves SRI (A-U), Moscow]

[Abstract] Studying the migration of chemical elements within ecosystems reveals some of the general functionalities in the ecosystem and helps optimize the struggle with pests by noting the accumulation patterns of toxic heavy elements in them. According to World Health Organization data, Cd, Pb, and Hg are the most widespread and dangerous. Superhighways with high-density traffic have been identified as one of the basic sources of heavy metal pollution of roadside soils and the micro- and mesofauna residing therein. During 1983-84 a study was made of heavy metal contamination in insects from agrocenoses in the vicinity of the Moscow beltway. Zinc was found to be the major heavy metal contaminant (45.2-4133.8 µg/g), followed by copper (11.7-37.9 µg/g) and lead (up to 15.0 µg/g). The concentration of heavy metals in insect tissues increased with nearness to the highway. Figure 1; references: 24: 13 Russian, 11 Western.

UDC 631.811.4:546.42:631.445.4

**Effect of Calcium-Containing Substances on Entry of Strontium-90 Into Crops From Leached Black Soil**

18410144e Moscow *AGROKHIMIYA* in Russian No 2, Feb 89 (manuscript received 11 Jan 88) pp 91-94

[Article by R. N. Kozhevnikova and I. G. Teplyakov]

[Abstract] Although much work has been done on growing non-radioactively contaminated produce in soils contaminated with strontium-90, there are no data on the supplemental addition of calcium-containing substances to such soils for the purpose of lowering strontium-90 uptake. The present work discusses a 3-year field experiment in which calcium-containing industrial waste products such as gypsum, lime, chalk, and cement dust were applied to leached black soil. Oats, wheat, and peas grown on this soil had 1.5-3.5 times less strontium-90. References 13 (Russian).

UDC 631.423.3:631.416.13

**Nitrate Determination in Soil Extracts on Clinical Analyzer KONE SD (Finland)**

*18410144h Moscow AGROKHIMIYA in Russian  
No 2, Feb 89 (manuscript received 3 Aug 87) pp 115-119*

[Article by Yu. V. Sokolova, Fertilizers and Soil Management SRI (AU), Moscow]

[Abstract] The reaction of pink diazonium compound is widely used for the determination of nitrites and nitrates

in water and soil. Nitrates are reduced to nitrites with various reducing agents such as metallic zinc or hydrazine solutions containing Cu, Cu-Cd, or Cu-Hg by striation in a column. However, it is very important to select conditions where the reduction is complete and proceeds only to the nitrite stage. In the present work optimum reducing conditions were determined for analyzing soil extracts for their nitrate content by using the clinical analyzer KONE SD. It was established that the presence of Mn ions and the optimum temperature (37°C) and time stabilizes the reducing conditions to give reproducible error-free results. Figures 3; references 16: 5 Russian, 11 Western.

UDC 541.183:546.21:541.49:546.34

**Properties of Lithium Tetraalkylborates in Adsorption-Desorption of Oxygen**

18410139a Moscow IZVESTIYA AKADEMII NAUK  
SSSR: SERIYA KHIMICHESKAYA in Russian  
No 2, Feb 89 (manuscript received  
27 Jul 87) pp 251-253

[Article by Z. T. Dmitriyeva, I. G. Ryzhikova, and V. I. Yerofeyev, Petroleum Chemistry Institute, Tomsk]

[Abstract] During the moment of their formation in solutions of low dielectric permeability, lithium tetraalkylborate complexes become autocatalytically polyassociated into three-dimensional structures. These complexes have been shown to have an ionic structure, with the alkali metal cation being in the tetracoordinated state. Prior to full coordinated saturation, this cation has two free bonds, so lithium tetraalkylborates are capable of solvation with electron-donor compounds. It has been further demonstrated that during the first stage of oxidative thermal destruction in air at 60°C there is an increase in mass in  $\text{Li}[\text{BOR}'(\text{OR})_3]$  complexes. Other data make it possible to hypothesize that lithium tetraalkylborates are capable of activating p-donor gases such as oxygen and to transpose them to the reaction sites of other molecules. In the present work a study of oxygen adsorption-desorption at 298-548 K of  $\text{Li}(\text{t-C}_4\text{H}_9\text{OB}(\text{OR})_3)$ , where R equals n-butyl, n-heptyl, and n-dodecyl, shows that these complexes are capable of oxygen chemisorption. The activation energy of oxygen thermal desorption from the complex increases as the degree of oxygen sorption decreases and as the length of the alkyl group becomes greater. Figure 1; references 9: 7 Russian, 2 Western.

UDC 546.48'19

**Tensimetric Study of  $\text{Cd}_3\text{As}_2$  Sublimation**

18410140a Moscow ZHURNAL FIZICHESKOY  
KHIMII in Russian Vol 63 No 2, Feb 89 (manuscript  
received 9 Dec 87) pp 325-328

[Article by G. D. Nipan, Ya. Kh. Grinberg, and V. B. Lazerev, General and Inorganic Chemistry Institute imeni N. S. Kurnakov, Moscow]

[Abstract] In a previous work on the sublimation of nonstoichiometric crystals by statistical tensimetry it was demonstrated that it is not possible to get a congruent sublimation curve  $S = V$  because the congruently sublimating composition of crystal  $x^{\text{cs}}$  changes with temperature. Therefore, any tensimetric curve inside the equilibrium region of crystal-vapor phases is divariant. However, standard mathematical treatment of tensimetric experimental data, carried out for the purpose of obtaining thermodynamic constants, assumes that, during congruent sublimation, vapor pressure remains as a single-value function of temperature, which is valid only for monovariant processes. Correct results may thus be

obtained only when the p-T-x equilibrium region of a crystal-vapor is known, and a tensimetric experiment must then be set up in such a manner that the experimental divariant curves do not diverge from the monovariant  $S = V$  curve by more than the limit of experimental error. In the present work statistical tensimetry was used to study congruent sublimation of  $\text{Cd}_3\text{As}_2$ . Standard enthalpy of formation values were calculated for both the second and third laws of thermodynamics for the alpha and beta phases, and the effects of departure from stoichiometry in  $\text{Cd}_3\text{As}_2$  on enthalpy are discussed. References 12: 7 Russian, 5 Western.

UDC 536.23

**Thermal Accommodation in Gas-Metal System. Part II. Heat Conductivity of Gases at Room Temperatures**

18410140b Moscow ZHURNAL FIZICHESKOY  
KHIMII in Russian Vol 63 No 2, Feb 89 (manuscript  
received 28 Dec 87) pp 334-338

[Article by N. Kh. Zimina and N. F. Molchanova, Railroad Engineers Institute, Moscow]

[Abstract] Accurately known gas transfer constants make it possible to determine functional parameters of molecular interaction. Until recently, viscosity coefficients have been preferred for this purpose, although more work has been done with heat conductivity. This is due to the great diversity in heat conductivity values obtained by various authors, which makes it difficult to get reliable data. At the present time the use of nonstationary heated filament techniques has resulted in values that agree to within a fraction of a percent. The chief reason for the divergence of heat conductivity data in gases, especially at high temperatures, is the failure to take into account the effects of thermal accommodation, i.e., incomplete energy exchange between the gas and solid body molecules, and the so-called film effect. In the present work these phenomena were taken into account in reviewing data of other authors on 11 technologically important gases to reconcile differences. References 15: 8 Russian, 7 Western.

UDC 541.1+536.42+532.1

**Experimental Study of Shear Viscosity Near Hypercritical Point in Solutions With Charged Components**

18410140c Moscow ZHURNAL FIZICHESKOY  
KHIMII in Russian Vol 63 No 2, Feb 89 (manuscript  
received 11 Jun 87) pp 359-363

[Article by L. A. Davidovich, T. Kh. Akhmedov, M. U. Inoyatkhodzhayeva, I. I. Shinder, and M. K. Karabayev, Thermal Physics Department, UzSSR Academy of Sciences, Tashkent]

[Abstract] The relationships of temperature and concentration to shear viscosity near the hypercritical point were studied experimentally for the case of propyl alcohol in water with sodium chloride as an electrolyte

additive. Without the additive, this solution has unlimited solubility of components, but with it striation occurs with the upper and lower limits of the heterogeneous phase. At certain values of component concentration (x), electrolyte concentration (c), and temperature (T), the upper and lower critical points merge into a single point called the hypercritical or "double" point. Analysis of the data shows that shear viscosity becomes doubled in value at the hypercritical point. Figures 4; references 8: 4 Russian, 4 Western.

UDC 631.85:631.812

**Agrochemical Properties of Molten Magnesium Phosphates. Report 2. Effect of Technological Conditions of Preparation of Molten Magnesium Phosphate on Its Effectiveness**

18410144a Moscow AGROKHIMIYA in Russian  
No 2, Feb 89 (manuscript received 11 Mar 88) pp 27-35

[Article by O. V. Neugodova, A. I. Ostanin, and L. V. Lapshina, Fertilizers and Insectofungicides SRI imeni Ya. V. Samoylova, Moscow]

[Abstract] Molten magnesium in the finely divided state has proved to be a highly effective means of providing crops with phosphorus pentoxide and magnesium oxide. Since there are large reserves of this fertilizer in the USSR, the Fertilizers and Insectofungicides SRI was charged with evaluating the fertilizer qualities of molten magnesium phosphate obtained electrothermally under several variants of production. The study was conducted (1982-86) with vegetational experiments described previously. In the present work a study was made of the effect of production technology on the effectiveness of the fertilizer. Specifically, the effects of phosphorus and magnesium composition, the method of melting (electric furnace or cyclone), the scale of operation, the particle size of the product, and the ratio of nutrients in it on different soil types were investigated. The results made it possible to match agrochemical requirements with fertilizer quality. References 5 (Russian).

UDC 631.811:631.582:(470.312)

**Effect of Fertilizers on Productivity of Crops and Soil Properties in First Cycle of Cereal Crop Rotation on Leached Black Soil**

18410144b Moscow AGROKHIMIYA in Russian  
No 2, Feb 89 (manuscript received 29 Feb 88) pp 42-47

[Article by V. I. Brovkin and N. F. Bulatov, Tula Agricultural Experimental Station]

[Abstract] At the Tula Agricultural Experimental Station an on-going project entitled "Effect of Systematic Fertilization on Agrochemical Properties of Leached Tula

Oblast Black Soil and Determination of Optimal Doses for Crops Under Cultivation" has been in progress since 1980. The soil, which is average for the region, had been under cultivation continuously for 15 years prior to the project. During that period, rotational cereal crops were raised with moderate amounts of mineral fertilizer being added. In order for the long-range experiment to yield maximum information on fertilizer requirements, a chief goal was the fertilizer dosage needs for each crop. The present study demonstrated that systematic fertilization and intensive crop rotation gave yields of 20, 43, 35, and 45 centners per hectare for peas, winter rye, oats, and barley, respectively. The basic properties of the soil did change significantly over the period. The optimal dosages found were N60P60K60 for winter rye and oats, and N90P60K60 for barley. Figure 1; references 3 (Russian).

UDC 631.811:633.511

**Cotton Plant Fertilization on Old Arable Land**

18410144c Moscow AGROKHIMIYA in Russian  
No 2, Feb 89 (manuscript received 25 Mar 88) pp 70-73

[Article by Zh. Batkayev, A. Abdraimov, and A. Budarina, Pakhtaaral Cotton Experimental Station, Chimbentskaya Oblast]

[Abstract] A study shows that under old arable land conditions on the prairie-gray desert soils of the Golodnoy Steppe, 250 kilograms per hectare [kg/ha] nitrogen and 120-140 kg/ha phosphorus should be applied to attain high yields of cotton (over 30 centners per hectare). It is not necessary to maintain over 300 mg of potassium per kg of soil. References 3 (Russian).

UDC 581.143:635.21

**Use of Growth Regulators on Potatoes**

18410144f Moscow AGROKHIMIYA in Russian  
No 2, Feb 89 (manuscript received 15 Mar 88) pp 95-99

[Article by V. V. Nemchenko and Yu. A. Vershinin, Kurgan Grain SRI]

[Abstract] In growing potatoes in various soil and climatic conditions there is often a need to regulate such processes as growth initiation, increase resistance to extremes in heat and cold, accelerate germination, and lower losses during storage. In the present work a study demonstrated that chlorocholine chloride, gibberellin, ethylene-producing preparations (Etrrel, Hydrel, and Camposan), senicants, and dessicants can be used to accelerate germination and growth, increase drought resistance, increase outflow of plastic matter from stalks, and improve planting quality. References 36 (Russian).

UDC 541.124:542.91:546.18:547.539.211.3

**Reaction of Red Phosphorus With Benzyl Halide in Super Basic System**

18410139i Moscow IZVESTIYA AKADEMII NAUK  
SSSR: SERIYA KHIMICHESKAYA in Russian  
No 2, Feb 89 (manuscript received 4 May 88) p 488

[Article by N. K. Gusarova, B. A. Trofimov, S. F. Malysheva, T. N. Rakhmatulina, Ye. P. Vyalykh, and M. G. Voronkov, Organic Chemistry Institute, Irkutsk]

[Abstract] It has been demonstrated recently that red phosphorus reacts with phenyl acetylene by heating in a superbasic system (alkali in an aprotic solvent) to form tristyryl phosphine. A key step in this reaction is the polyphosphide anion attack on the acetylene triple bond generated by the super base. It developed further that organyl halides may also be used as electrophiles. In the present work red phosphorus was found to react with benzyl chloride at 80-100°C in KOH/DMSO (or GMFA) to form tribenzylphosphine oxide in a 65% yield. A reaction mechanism is presented. References 2 (Russian).

UDC 542.91:547.1'118

**Reaction of Hexafluoropropylene Oxide With Triethyl Phosphite**

18410139j Moscow IZVESTIYA AKADEMII NAUK  
SSSR: SERIYA KHIMICHESKAYA in Russian  
No 2, Feb 89 (manuscript received 8 Jun 88) p 489

[Article by A. A. Kadyrov, Ye. M. Rokhlin, M. V. Galakhov, and Ye. I. Mysov, Elementoorganic Compounds Institute, Moscow]

[Abstract] It has been demonstrated recently that perfluoroisobutylene oxide reacts with  $(\text{EtO})_3\text{P}$  to form the phosphorylide  $(\text{CF}_3)_2\text{C}=\text{P}(\text{OEt})_3$ . However, an analogous reaction with hexafluoropropylene oxide results unexpectedly in a dialkoxydiene not containing phosphorus and an unsaturated ester. Apparently, these two products are formed as a result of a series of successive conversions of the phosphorylide. Reference 1 (Russian).

UDC 632.951

**Relationship Between Anticholinesterase Activity of Certain Insecticides and Their Toxicity**  
*18410144g Moscow AGROKHIMIYA in Russian No 2, Feb 89 (manuscript received 28 Mar 88) pp 100-104*

[Article by G. M. Grigoryeva, T. I. Krasnova, K. V. Novozhilov, Ye. V. Nikanorova, I. M. Smirnova, A. Ye. Khovanskikh, and Ye. V. Kharchenko, Evolutionary Physiology and Biochemistry Institute imeni L. M. Sechenov, Leningrad; Plant Protection SRI (AU), Leningrad]

[Abstract] Factors governing selective toxicity must be taken in consideration in the rational utilization of organophosphorus pesticides (OPI). Such factors include metabolism of the pesticide in the insect's organism and cholinesterase inhibition in its nervous system. It has been established that the basic forms of OPI metabolism are associated with the action of oxidative and hydrolytic enzymes. The different forms of these enzyme systems and the differences in reaction rates (catalyzed by these systems) in the organisms of mammals and various insect species suggest that broad-spectrum insecticides could manifest selective toxicity. Cholinesterase is a target of organophosphorus toxicants regardless of

the metabolic route, and a relationship has been established between anticholinesterase activity and selective toxicity for a number of OPIs. The anticholinesterase activity of pesticides such as Gardon and Diazinon has been studied previously on such targets as house flies and roaches. In the present work a study was made of the action of these pesticides on the cholinesterase of other insects such as the cabbage fly, aleochara, Colorado beetle, white cabbage butterfly, and common aphid. Anticholinesterase activity was gauged by a bimolecular reaction rate constant calculated by a formula and based on experimental data of initial and final enzyme activity obtained from the heads and thoraxes of the insects. It has been established that the pesticides have low toxicity to mammals (for Gardon, an LD<sub>50</sub> of 1,900-5,000 mg/kg perorally for mice and over 2,500 cutaneously for rats and rabbits; for Diazinon, 455-900 cutaneously for rats and rabbits). In the case of Gardon, a distinct correlation was found between anticholinesterase activity and toxicity for all insects studied. For Diazinon, whose toxicity is chiefly due to the accumulation of diazoxone oxidation products, such a correlation exists only for some species. The toxicity of Diazinon depends not only on the action of diazoxone but also on the dynamics of its formation and decomposition, i.e., the metabolic processes in the insect's organism. References 20: 11 Russian, 9 Western.



UDC 553.98:556.3

**Hydrologic Conditions for Development of Deep Gas Deposits in Dneprov-Donets Basin**

18410130a Kiev NEFTYANA I GAZOVAYA  
PROMYSHLENNOST in Russian  
No 1, Jan-Mar 89 pp 5-8

[Article by A. P. Zaritskiy, I. I. Zinenko, and Ye. D. Belykh, Ukrainian Gas Scientific Research Institute]

[Abstract] The geologic features of deep natural gas deposits in the Dneprov-Donets Basin, which have been classified as the Katageneticheskii fluid trap, complicate prospects for development. These include an anomalously high stratal pressure, the presence of aggressive components in subsurface water, and wide variations in water content. The Solokhovskiy site, which is the oldest project for developing these deposits, has experienced intense, unexpected well flooding. This may be due to elastic water vapor behavior and rapid draining of collectors due to well location. Flooding has also occurred at other sites. Interstice-crack collectors, which lose permeability as pressure decreases due to gas removal, cause this phenomenon. Depressed water mineralization levels are frequently observed. Removal of water should be undertaken during early well development in the Dneprov-Donets Basin. References 11 (Russian).

UDC 622.276.43

**Conditions for Petroleum Reserve Development**

18410130b Kiev NEFTYANA I GAZOVAYA  
PROMYSHLENNOST in Russian  
No 1, Jan-Mar 89 pp 27-29

[Article by N. N. Gunka, Dolinaneftgaz]

[Abstract] During the development of precarpathian oil fields, water injection techniques were found to result in long-lived cooling zones. A comparison of the temperature and pressure in the injection and control wells demonstrated that the two parameters are closely connected. Limiting or eliminating cold water injection promotes more intensive development of petroleum reserves from stagnant or cooled portions of the deposits. Inundation to 30% is optimal; above this value, petroleum phase permeability decreases. The portion of water in the flowing stream decreases significantly with increasing temperature, while the amount of petroleum increases. Long-term water injection into highly permeable strata lowers the critical zone temperature to a radius of 250-350 m from the pump, which leads to the formation of nonnewtonian strata. When developing deep multistratum deposits, the most economical means of raising temperature is to use the deep heat of the earth by means of interrupted injection until the displacing water is saturated. References 8 (Russian).

UDC 622.279.23/4

**Determination of Condensate Level in Formation Gas Using Stratum Loss Method**

18410130c Kiev NEFTYANA I GAZOVAYA  
PROMYSHLENNOST in Russian  
No 1, Jan-Mar 89 pp 30-32

[Article by Ya. V. Savchuk, Black Sea Branch, Ukrainian Petroleum and Gas Research Institute]

[Abstract] In order to improve existing methods for calculating condensate concentration in formation gas, a system of differential equations was developed. Differentiating and rearranging the material balance expressions led to an equation describing the process of differential condensation. A general solution of this equation involved experimental results determined in a PVT bomb. The small linear segment approximation was also used to arrive at a solution. Stratum loss and residual gas quantities were determined graphically from the results of PVT bomb experiments. The method proposed permits accurate calculation of the condensate content and the coefficient of condensate recovery at any initial stratum pressure and condensate content since it considers the real properties of the formation gas and distribution of residual gas between the liquid and gas phases. The method is suitable for calculations based on wet or dry gas. References 3 (Russian).

UDC 622.279.23/4

**Treating Gas Condensate Pump Critical Zone with Carbon Dioxide**

18410130d Kiev NEFTYANA I GAZOVAYA  
PROMYSHLENNOST in Russian  
No 1, Jan-Mar 89 pp 33-35

[Article by R. M. Ter-sarkisov, M. A. Peshkin, and Ye. S. Bikman, All-Union Gas Scientific Research Institute and Ukrainian Gas Scientific Research Institute]

[Abstract] The injection of carbon dioxide into the rammer zone of well no. 1 in the Timofeyevskiy gas condensate site was studied. High levels of condensate in the stratum gas, on the order of 400 g/m<sup>3</sup>, are characteristic of this site. The 96°C temperature and 41.3 MPa initial pressure of the well substantially exceeded the miscible displacement limit of 15.5 MPa. In recent years, exploitation of well no. 1 has been complicated by the accumulation of liquid condensate on the rammer and by hydrate formation in the upper shaft. Immediately before carbon dioxide injection, the stratum pressure was 15.8 MPa, and the well head was pressure 10.4 MPa. Carbon dioxide injection proceeded, with interruptions, for about 1.5 months. About 100 tons was introduced into the rammer zone. This amount was calculated to affect a cylinder with a radius of about 7.2 m. During injection, the well head pressure fell to 1.2 MPa. After completion of the injection, this value rose first to 4.0 MPa, then to 5.6 MPa. This change in pressure is due to

the gradual transition of the liquid carbon dioxide to gas in the well shaft. After termination of injection in well no. 1, well no. 50 produced 40,000-50,000 m<sup>3</sup> of natural gas at a pressure of 16 MPa over 12 hours. Well no. 1 was returned to service after 10 days and was found to produce 50,000-55,000 m<sup>3</sup>/day at 5-6 MPa, which represented a twofold increase in productivity. The gas condensate factor increased to 182 g/m<sup>3</sup>, and the absolute free yield rose from 43,000 to 74,000 m<sup>3</sup>/day. A pulsed operating mode was necessary because of an accumulation of condensate on the rammer. The data confirm the theoretical concepts that form the basis of the technological process. References 3 (Russian).

UDC 622.245.542

#### Method for Selection of Gunpowder Charge Mass for Stratum Fracture

18410130e Kiev NEFTYANA I GAZOVAYA  
PROMYSHLENNOST in Russian  
No 1, Jan-Mar 89 pp 38-40

[Article by S. V. Klibanets and A. M. Abdulzade, Ivanov-Frank Institute of Petroleum and Gas]

[Abstract] Blast energy has a complex effect on well productivity: crack formation, heat, physicochemical interactions with gaseous blast products, and pressure pulses. Crack formation is chiefly connected with the flow of elastic energy from the blast source. Maximal crack formation is achieved by retarding the process of crack charging so that the pressure pulse occurs over tens to hundreds of milliseconds. This is best achieved by using gunpowder. One of the necessary factors to be considered when planning gunpowder use is the length of the crack needed, which is calculated from stratum permeability, the degree of degradation of filtering properties in the zone near the well, and the radius of this zone. Energy balance calculations were used to determine the gunpowder charge mass needed for a seam located near a well by assuming maximal perforation density and the forcing of a gas-liquid mixture into 75% of the crack length during charge combustion and crack development in one plane. Calculations were conducted on a computer and the results presented graphically (crack radius and opening were presented as functions of the gunpowder charge mass for wells of 2000, 3000, 4000, or 5000 m in depth). The slope of the curves generated was found to decrease as the charge mass increased. Using an equivalent charge for a 5,000-m-deep well and a 2,000-m-deep well decreased crack length by a factor of two for the former, with little change in crack width. The results of the method have been verified in field tests.

UDC 662.75

#### KATAEka Coals as Feedstock for Various Fuel Refabrication Trends

18410133a Moscow KHIMIYA TVERDOGO TOPLIVA  
in Russian No 1, Jan-Feb 89 (manuscript received  
28 Apr 86) pp 3-10

[Article by K. V. Gavrilin, Complex Thematic Expedition of "Krasnoyarsk" Association]

[Abstract] The Kansk-Achinsk Fuel-Energy Complex (KATAEka) will be the major fuel-energy complex of the Soviet Union up to the year 2000. With the start-up of the Berezhov cut, this coal basin now takes third place after the Donbass and Kuzbass basins in volume of production. Thus far, all of the coal is being used exclusively for energy purposes. Thirteen strip sections have been prepared for future Kansk-Achinsk cuts that should last for many decades as a basic energy source for large-scale electric power stations and fuel refabrication enterprises. The structure and locations of coal refabrication enterprises for future KATEKa cuts have not yet been determined owing to many problems such as finding the optimum utilization of individual deposits. Coals from various strips are dissimilar, and it becomes important to correctly appraise them for various specific methods of utilization and plan the location of refabrication facilities. However, concrete GOST-regulated technical requirements on coal quality for large-scale refining still do not exist. Also, there are no GOST standards to control such parameters as ash composition and melting point and calcium and alkali oxide content, which determine burning and slag removal systems and are especially important in designing electric power stations. In the present work the basic properties of coals from the new cuts are examined. Certain strips containing coals with high melting ash and coal resources having various ash groupings were selected. An estimate of the comparative effectiveness of various method of refabrication such as enrichment, in situ burning, and liquid fuel production are presented. Figures 3; references 10 (Russian).

UDC 543.53:546.62

#### Determination of Element Composition of Coals with Nuclear Physics Methods

18410133b Moscow KHIMIYA TVERDOGO TOPLIVA  
in Russian No 1, Jan-Feb 89 (manuscript received  
21 Oct 87) pp 11-15

[Article by N. Sodnom, Sh. Gerbish, O. D. Maslov, K. A. Gavrilov, and A. G. Belov, United Nuclear Research Institute]

[Abstract] Traditional wet chemical and optical methods are not suitable for multielement analysis of coals. This can only be done by using combined instrumental neutron-activation analysis (INAA), instrumental gamma-activation analysis (IGAA), and X-ray-fluorescent analysis

(RFA). Activation can be achieved through a variety of irradiation sources, depending on the degree of sensitivity required. If the threshold is not less than 0.001 g/t, activation may be achieved on nuclear reactors, although they are not always available. A simpler and more readily available method of activation consists of using a microtron that provides a detection limit of  $10 \cdot 10^{-2}$  grams per ton. Radioisotope sources for neutrons and gamma-quanta are more available and simpler, although they sometimes fail to provide the needed sensitivity. In the present work a comparison was made of the results of brown coal analysis using INAA, IGAA, and RFA methods. It was demonstrated that the use of the microtron makes it possible to determine over 40 industrially and ecologically interesting elements to detection limits of  $10^{-3}$  to  $10^{-5}\%$ . Figure 1; references 8: 7 Russian, 1 Western.

UDC 662.743

#### Features of Thermochemical Conversions of Kaa-Khemsk Coals

18410133c Moscow *KHIMIYA TVERDOGO TOPLIVA* in Russian No 1, Jan-Feb 89 (manuscript received 22 Dec 87) pp 22- 28

[Article by N. I. Sodnam, O. D. Bondarenko, A. A. Shklyayev, M. L. Shchipko, and B. N. Kuznetsov, Chemistry and Chemical Technology Institute, Krasnoyarsk]

[Abstract] The Kaa-Khemsk deposit is the main fuel source in the Tuva ASSR, and it is also a potential feedstock for the coke and chemical industries. For these reasons study of the thermochemical conversions of this coal is needed. In the present work infrared analysis of the pyrolysis products of Berozov brown coal, gaseous Kaa-Khemsk, gaseous Kuznetsk, and fatty Kuznetsk coals shows that the gaseous Kaa-Khemsk coal has a lower degree of metamorphosis, a very high state of reduction, and a higher oxygen concentration in the organic mass. Pyrolysis of Kaa-Khemsk coal to 450°C results in a higher concentration of paramagnetic sites due to the rapid formation of aryl radicals. Oxygen-containing groups are contained mostly in the gaseous phase, while the liquid phase is enriched with hydrogen. Kaa-Khemsk coal has a high caking capacity and is thus a valuable coking source. Figures 3; references 4: 3 Russian, 1 Western.

UDC 533.93:66.094.3

#### Thermogravimetric Study of Kinetics and Mechanism of Gas Phase Oxidation of Anthracite With Nitric Acid

18410133d Moscow *KHIMIYA TVERDOGO TOPLIVA* in Russian No 1, Jan-Feb 89 (manuscript received 23 Mar 88) pp 50- 54

[Article by V. A. Sapunov, Ye. S. Rudakov, V. A. Kucherenko, and S. I. Gazarinova, Physical Organic Chemistry and Coal Chemistry Institute, Donetsk]

[Abstract] Thermogravimetry has been used widely to study solid-phase reactions such as those of carbonaceous materials with gaseous oxidants. While the reactions of carbon and graphite with oxygen, carbon dioxide, and steam have been well studied, data on reactions

with gaseous nitric acid are sparse. It was established in a previous work that gaseous nitric acid rapidly penetrates anthracite at temperatures above 130 °C and oxidizes it to oxy coal, a product containing up to 50% oxygen, mainly as carboxyl groups. In the present work a new open-type thermogravimetric kinetic setup for studying solid-phase reactions in acid vapors is described. It consists of a reactor, evaporator, thermostat, titanium cup measuring cell, torsion balance, and nitric acid absorber. This was used to study the oxidation of anthracite with nitric acid and steam vapors at 120-180°C. The results show that the kinetic curves have an extreme shape that may be explained within the framework of a mechanism that presupposes the preliminary formation of anthracite-nitric acid compounds and their subsequent oxidation. The proposed open-type kinetic setup is a convenient method for studying the kinetics and reaction mechanism of coals and graphites with gaseous reagents. Figures 4; references 11: 7 Russian, 4 Western.

UDC 622.743

#### Filtration of Liquid Products of Thermal Dissolution of Coals

18410133e Moscow *KHIMIYA TVERDOGO TOPLIVA* in Russian No 1, Jan-Feb 89 (manuscript received 17 Nov 87) pp 55- 63

[Article by Ye. G. Gorlov, O. V. Zotova, and V. A. Ruban, Mined Fuels Institute]

[Abstract] Two currently used methods for coal liquefaction are hydrogenation and thermal dissolution. Hydrogenation is used to prepare distillate fractions, while thermal dissolution results in high-boiling point extracts that are quickly separated into liquid products. Separation of these products from the slurry is encumbered, however, by the nearness in density of the solid and liquid phases, which adhere strongly to one another owing to the use of hydrogen-donor solvents. Also, the extract has a high boiling point. The slurry may be separated by various methods such as filtration, centrifuging, hydrocycloning, distillation, or extraction, depending on the chemical composition and physical properties of the liquid products. In the present work a study was made of the separation of liquid products from the slurry resulting from thermal dissolution of Kansk-Achinsk brown coal by filtration and centrifuging. The slurry was prepared by liquefaction of the coal in a continuous laboratory reactor at 400-430°C, 3-5 MPa pressure and a 1:1.8 coal-to-solvent ratio. The solvent consisted of 30% tetralin and 70% of a distillate fraction obtained from semicoking a coal tar. Liquid products were separated by filtration at 20-150°C and 0.15-1.0 MPa pressure, with 60-70% of the separation occurring at 80-150°C and 0.3-0.5 MPa. Adding toluene and filtration aids such as brown coal ash and perlite enhances the slurry filtration process. Figures 3; references 9: 3 Russian, 6 Western.

UDC 66.092.662.75

**Hydrogenation of Brown Coal in Presence of Coal Solvent and Ore Tailings as Catalyst With Low-Contact Time**

18410133f Moscow *KHIMIYA TVERDOGO TOPLIVA* in Russian No 1, Jan-Feb 89 (manuscript received 26 Jan 88) pp 64-67

[Article by V. G. Lipovich, V. P. Gredyakin, V. G. Zhilin, V. D. Geshele, and V. V. Zemskov, High Temperatures Institute, Moscow]

[Abstract] Research on Kansk-Achinsk brown coal liquefaction has demonstrated the importance of self-sufficiency in the coal hydrogenation process through use of coal hydrogenate as a paste former, the latter acting as a hydrogen donor. Previous work has shown that the medium and heavy coal hydrogenation oils are capable of hydrogen transfer reactions with the coal in the presence of molybdenum and iron catalysts. However, using these catalysts raises the cost of the process due to catalyst regeneration. This increased the need to study the possibility of using low-cost and available nickel ore tailings as catalysts. In the present work Kansk-Achinsk brown coal was hydrogenated with a paste former consisting of various fractions of coal hydrogenate with boiling points above 300°C. The results demonstrate that optimum conditions for Kansk-Achinsk brown coal liquefaction are a temperature of 425-430°C, 10-11 MPa pressure, an hourly space velocity of 5, and 0.5% nickel ore tailings (based on the organic mass of the coal). Changing the quantity of ore tailings increases the degree of organic mass conversion but has little effect on the composition of the hydrogenate. References 3: 1 Russian, 2 Western.

UDC 662.743

**Determination of Optimal Process Conditions for Extraction of Coal Slurries**

18410133g Moscow *KHIMIYA TVERDOGO TOPLIVA* in Russian No 1, Jan-Feb 89 (manuscript received 2 Sep 87) pp 68-75

[Article by Ye. D. Bakhareva, Ye. G. Gorlov, N. A. Gorykova, O. V. Zomova, and V. A. Ruban, Mined Fuels Institute]

[Abstract] Coal hydrogenation at 10 MPa pressure and 420-425°C by the Mined Fuels Institute method results in gasoline and diesel fractions, a slurry consisting of high-boiling point hydrocarbons, and a solid phase. The solid phase consists of unconverted organic matter, an organic-mineral portion, and mineral particles. The electrostatic bonds with which the hydrocarbon phase is associated to the solid phase must be broken in order to get the highest possible yield of liquid products. The liquid products may be separated from the slurries by

using a variety of methods such as extraction, distillation, filtration, centrifuging, or hydrocycloning, depending on the desired end product. To determine the optimum process for refining the slurry, it is first necessary to have mathematical models of the various refining methods correlating the technological parameters with the properties of the products. In the present work mathematical models for the extraction of hydrogenate slurry from Irsha-Borodinsk brown coal as a function of temperature, extraction time, and type of solvent are presented. Asphaltene content and the zones of technological parameters for extraction of the slurry are determined for various solvents. The zones were calculated by taking into account given limitations on the yield of liquid products and the content of asphaltenes in them. Figures 2; references 2: 1 Russian, 1 Western.

UDC 621.742.48.001.5

**Study of Thermal Conversions of Pitch-Polymer Binders**

18410133h Moscow *KHIMIYA TVERDOGO TOPLIVA* in Russian No 1, Jan-Feb 89 (manuscript received 28 Dec 87) pp 81-84

[Article by A. I. Demidova, L. Ye. Djoroginina, V. I. Perepechenykh, and A. S. Fialkov, VNIIEI]

[Abstract] Pitch-polymer binders, prepared by blending coal tar with phenolic or furanic resins, are used to reinforce and control certain physicomachanical properties of carbon-graphite materials. However, the excessive addition of polymers results in lower graphitization and a deterioration of machinability and antifriction and electrophysical properties. In the present work an EPR study was made of the effects of synthetic polymers on the paramagnetic permeability in coal tar during heat treatment to determine the optimum composition of pitch-polymer binders. The pitch-polymer binders were prepared from medium-temperature coal tar (GOST 10200-83) and phenolformaldehyde resin SF-342 A (GOST 18074-80) or difurfurylindene acetone (furfurool-acetone condensate). The latter, in a 10% quantity, developed to be the most active additive from the standpoint of thermal destruction and graphitization. Figures 4; references 7 (Russian).

UDC 661.666.1

**Preparation of Carbon Fiber by Disproportionation of Carbon Monoxide Over Iron-Containing Catalysts**

18410133h Moscow *KHIMIYA TVERDOGO TOPLIVA* in Russian No 1, Jan-Feb 89 (manuscript received 30 Mar 88) pp 111-115

[Article by N. S. Pechuro, V. K. Frantsuzov, and B. V. Peshnev, Fine Chemical Technology Institute]

[Abstract] Iron catalysts are known to be among the most active catalysts in the disproportionation of carbon monoxide to form carbon fiber. Many believe that

disproportionation of CO precedes the formation of surface sites having carbide phases and that carbon fiber formation is related to carbide decomposition, although the roles of alloys and inhibition due to carbides have also been noted. In view of these contradictions, a study was made of some features of the formation of carbon fiber from CO over three metallic iron catalysts containing 98.75, 99.24, and 99.88% by weight of iron. Experiments were conducted in a continuous-type reactor at 450-600°C and a 600-2,200 carbon monoxide hourly space velocity in the presence of 4-7 g of catalyst. The results demonstrate that carbon monoxide disproportionation takes place at the carbide phase surface sites that form during the induction period. The effects of temperature, carbon monoxide feed rate, and carbon content in the catalyst on the selectivity of the process, productivity of the catalyst, carbon fiber yield, and the adsorption surface area of the latter have been clarified. Figures 3; references 12: 9 Russian, 3 Western.

UDC 62-405.8:677.529:661.183

#### **Porous Structure Development During Activation of Carbon Fiber Materials**

18410133j Moscow *KHIMIYA TVERDOGO TOPLIVA* in Russian No 1, Jan-Feb 89 (manuscript received 23 Jun 87) pp 116-120

[Article by V. P. Sergeyev, V. N. Sokolovskiy, V. N. Klevtsov, V. K. Lukashov, N. Yu. Pimonenko, N. I. Mishchenko, and T. P. Tantsyura, Problems of Material Science Institute, Kiev]

[Abstract] Activated carbon fiber materials (AUV) have unique sorption properties and are widely used in modern technology and medicine. The sorption activity of these materials is usually regulated by high-temperature oxidizing treatment, i.e. activation, which presets their porous structure. A previous study showed that the initial properties of the material and the method and conditions of activation have the greatest effect on the development of the porous structure. Therefore, experimental study of the effects of these factors on the structure of AVUM should provide useful information on the structure of carbon adsorbents and the optimum conditions for activation. In the present work x-ray diffraction, raster scan electron microscopy, and density measurement were used to obtain data on porous structure formation in activated carbon fiber material DNEPR as a function of the degree of carbonization oxidation. Three areas of structure formation during steam activation of the carbonization were identified. The first area is characterized by a predominant growth of micro- and macropores. The second has mesopores, and the third area has meso- and macropores. Figures 4; references 9 (Russian).

UDC 661.66

#### **Positron Annihilation in Carbon Materials**

18410133k Moscow *KHIMIYA TVERDOGO TOPLIVA* in Russian No 1, Jan-Feb 89 (manuscript received 30 Sep 87) pp 121-125

[Article by A. D. Mokrushin, L. A. Kondrashenkova, V. P. Shevyakov, and N. N. Shipkov]

[Abstract] Today, many composite materials use fillers made up of carbonaceous materials with varying degrees of heat treatment and fineness such as coke, carbon black, carbon fiber, and graphite. Coal pitch and tar are frequently used as binder materials. During the preparation of these composite materials, filler-binder interaction depends largely on the microporosity and surface status of the filler. Positron annihilation could provide interesting information on these characteristics of carbonaceous materials. A pronounced relationship between the shape of the angular distribution of annihilation photons and crystal orientation has been observed in monocrystalline graphite, one of the most anisotropic materials. Calculations show that the observed anisotropy of the angular distribution of annihilation radiation may be due to the well expressed pattern of  $\delta$ - and  $\pi$ -bonds in the carbon atoms of the graphite structure. Other data indicate that a single annihilation mechanism exists at a high degree of fineness, which is somehow related to the formation of surface states of positrons. In the present work the angular distribution of photons during electron-positron annihilation was measured in heat-treated and non-heat-treated petroleum coke, vitrified carbon, carbon black, and graphite quasi-single crystals. Analysis of the data shows that positrons are annihilated both in the free state and while captured in structural defects where the local electron density is below average. Carbon black and vitrified carbon have similar annihilation characteristics, as may be expected from their structure. A method is presented for determining the quality of crystal graphite and its degree of anisotropy by using the annihilation method. Figures 2; references 9: 2 Russian, 7 Western.

UDC 661:666.2

#### **Preparation of Vermicular Graphite**

18410133l Moscow *KHIMIYA TVERDOGO TOPLIVA* in Russian No 1, Jan-Feb 89 (manuscript received 5 Mar 88) pp 126-130

[Article by V. V. Shapranov, A. P. Yaroshenko, V. A. Kucherenko, and V. A. Shablovskiy, Physical Chemistry and Coal Chemistry Institute, Donetsk]

[Abstract] Vermicular graphite (VG) is a laminar compound of graphite that is capable of considerable expansion in volume at temperatures above 500°C. It includes graphite bisulfate, a compound of transitional composition,  $C_x^+HSO_4^-mH_2SO_4$ , where  $x$  may be 24, 48, 72, or higher and  $m$  is equal to or greater than 2. Graphite



bisulfate is usually prepared by oxidation of the starting material in a potassium dichromate-sulfuric acid-water solution, washing out the unreacted sulfuric acid with water, and drying. This method is not entirely satisfactory due to the number of operations and the large amount of acid effluent. VG is produced from graphite bisulfate on an industrial scale at the Donetsk Metallurgical Plant imeni V. I. Lenin, where the substance is used as a component in exothermal antishrinking agents used in casting nearly 8 million tons of steel annually. The process includes oxidation of graphite with the chromic acid anhydride followed by treatment with magnesium oxide. The filtration, washing, and drying steps are excluded, and there is no acid waste. Current technology is based on using coarse-grained graphite as a starting material. Fine-grained graphite is less costly but results in poor-quality VG. The present work was undertaken to study the formation of VG from fine-grained graphite and to establish the relationship of its swelling capability to the oxidation conditions used at the Donetsk Metallurgical Plant. The results demonstrate that fine-grained graphite may be used to produce VG of satisfactory quality and the product may be stored in air-tight containers for up to 3 months without any loss of swelling capability. Figures 2; references 18: 13 Russian, 5 Western.

UDC 665.765-404:621.892.09.004.14

**Standardization of Industrial Oils Assortment**  
18410138a Moscow *KHIMIYA I TEKHOLOGIYA*  
*TOPLIV I MASEL in Russian No 2, Feb 89 pp 6-8*

[Article by K. M. Badyshova, N. M. Litvinova, E. B. Ivankina, E. K. Gabdusheva, and A. V. Vanina, Petroleum Refining SRI (A-U), Kuibyshev Branch]

[Abstract] The quality and available assortment of industrial oils must be improved to develop and use new automation technology. This can be achieved through the use of additives to improve quality and extend the service life of various mechanisms. In the leading capitalist countries about 90% of industrial equipment now operates on lubricants containing additives, and this figure is increasing each year. The USSR produces about 90 types of oil, only 3.5% of which contain additives. Increasing this to 30% would more than cut the average annual increase in demand in half by increasing the service life of the oil. In order to increase the production of high-quality additive oils, both the volume and quality of base oil production must be improved, and the assortment of additive oils must be standardized. In 1975 the International Standards Organization (ISO) introduced standard 3448-75, "Industrial Lubricant Materials. ISO Viscosity Classification". This established the level of kinematic viscosity of industrial lubricants at 40°C. Leading foreign oil companies such as Shell, BP, Mobil, and Esso brought the viscosity level up to this standard, while in the USSR only five oils meet this standard. In 1978 the 40°C kinematic viscosity index began to be applied in domestic industrial oils in

accordance with ISO 3448-75. To comply with ISO 3448-75 and ISO 3498-79, GOST 17479.4-87 has been developed and put into use on 1 Jul 1988. This standard set up four groups of designation symbols. The letter I designates the first group, industrial oil. The symbols of the second group are: L, light-duty oils; N, carriage slides; G, hydraulic systems; T, heavy-duty transmission gears. The third group uses the letters A, B, C, etc., to designate service properties (antioxidant, corrosion resistant). In the fourth group a number signifies the class of kinematic viscosity at 40°C according to ISO 3448-75. For example, I-G-B-46 indicates an industrial oil designated for hydraulic systems containing antioxidant and corrosion resistant additives and refers to class 46 in viscosity. A table lists both the old and new designations of oils. To convert the majority of industrial oils to the new GOST 17479.4-87 viscosity standard, it is first necessary to alter boiling point limits of oil distillates. References 6 (Russian).

UDC 621.315.615.2

**Impregnating Compositions Based on Residual Oil Component**

18410138b Moscow *KHIMIYA I TEKHOLOGIYA*  
*TOPLIV I MASEL in Russian No 2, Feb 89 pp 8-10*

[Article by T. I. Komarenkova, S. S. Yezheva, V. R. Ryabov, and V. V. Tokarev, Perm Polytechnical Institute; "Kamkabel" Production Association]

[Abstract] Depletion of Volgograd oils has forced a search for new sources to produce impregnating compositions for KM-25 cable oil, which is used to impregnate the paper insulation on power line cables. These oils must have a sufficiently high dielectric permeability, a low angle of dielectric loss, and low viscosity at impregnation temperatures (105-120°C) and high viscosity at the service temperatures of the cable (50-80°C). To select an oil meeting these requirements, a study was made of some of the products from the "Permnefteorgsintez" Production Association, which uses West Siberian and Perm Oblast crudes. After treatment with bleaching earths, the products were tested for electrical characteristics and viscosity. Only the bottoms stock was found to be suitable. Further tests for catalytic activity with copper and aging showed that the component can be used, but only after adsorption refining with the bleaching earths. References 2 (Russian).

UDC 665.644.2.097.38

**Improving Regeneration Technology With Catalytic Oxidation of Carbon Monoxide**

18410138f Moscow *KHIMIYA I TEKHOLOGIYA*  
*TOPLIV I MASEL in Russian No 2, Feb 89 pp 17-18*

[Article by B. Z. Solyar, V. A. Stankevich, B. M. Zhitomirskiy, T. Kh. Melik-Akhazarov, V. I. Markhevka, A. I. Samokhvalov, and A. S. Shelestov, Petroleum Refining SRI (A-U), Moscow]

[Abstract] During the design stage of the carbon monoxide conversion unit G-43-107, a catalyst regeneration variant was adopted with partial combustion of the



carbon monoxide into dioxide at the incipient zone of the reactor. Oxidation of the CO was to be regulated through the temperature difference between the incipient and fluidized zones. However, this method of control failed to provide deep conversion of CO at the regeneration zone and also failed to prevent uncontrolled combustion of CO in the dome and cyclones of the regenerator. Initial design decisions were reconsidered following both domestic and foreign experience with catalytic cracking units, and it was recommended that a platinum-containing promoter be used in conjunction with the catalyst. With no temperature restrictions, the process is most efficiently conducted with full oxidation of the CO in the fluidized bed. However, under these conditions, no single parameter of the process can give any indication of the level of oxidizing activity of the catalyst and thereby fails to provide parameter control. To gauge its activity, samples of the catalyst were tested in a laboratory-scale vibrofluidized reactor using a model mixture of air and CO with the degree of CO to CO<sub>2</sub> conversion being used as an indicator. The results showed that the promoter becomes irreversibly deactivated and is carried off with the stack gases, and it is thus necessary to keep adding promoter to the system. Figures 2; references 8: 7 Russian, 1 Western.

UDC 665.637.8+665.775.035

**Sequence of Distillation and Oxidation Processes During Production of Road Bitumens**

18410138b Moscow *KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL in Russian No 2, Feb 89 pp 10-13*

[Article by I. B. Grudnikov, Bashkir Oil Refining SRI]

[Abstract] Conventional technology for the production of road bitumens is based on sequential distillation of mazout and air oxidation of the resulting bottoms stock. In the present work a reversal in the sequence is proposed where a portion of the mazout is oxidized first and the resulting mixture of oxidized and nonoxidized mazout is then vacuum distilled to bitumens. Oxidation of the mazout converts the aromatic hydrocarbons into higher-boiling point compounds that remain in the bottoms stock after the distillation. The resulting bitumen has a higher content of aromatic compounds and greater ductility, which makes it possible to include a number of high-paraffin crudes for bitumen production. References 30: 23 Russian, 7 Western.

UDC 547.562.4

**Multifunctional Alkylphenol Additive**

18410138d Moscow *KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL in Russian No 2, Feb 89 pp 14-15*

[Article by G. A. Zeynalova, A. Ye. Mushailov, A. Kh. Mamedova, and E. A. Nagiyeva, Chemical Additives Institute, Baku]

[Abstract] One of the basic components in Baku motor oils is a highly alkaline additive IKhP-101. Although it has good antioxidant and corrosion resistance properties, it

has unsatisfactory detergent and viscosity-temperature properties. To improve the properties of the additive, polyisobutylene was introduced at the alkylphenol-formaldehyde condensation stage. The new experimental additive, named IKhP-111, was then tested by standard laboratory methods and compared with the commercial IKhP-101. The results show many improvements in detergent, antioxidant, viscosity-temperature, and corrosion resistance properties. References 2 (Russian).

UDC 547.494.254+621.892.8

**bis-Xanthogenates and bis-Dithiocarbamates as Lube Oil Additives**

18410138e Moscow *KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL in Russian No 2, Feb 89 pp 15-16*

[Article by A. M. Kuliyeu, Ch. A. Yusifov, M. A. Kuliyeu, F. Yu. Aliyev, and A. A. Amirova, Chemical Additives Institute, Baku]

[Abstract] Increased loads and higher-paced operating conditions have considerably increased the requirements of lube oil additives. The presence of sulfur and nitrogen in the composition of xanthogenic and dithiocarbamic acid esters makes it possible to use them as lube oil additives. In the present work bis-xanthogenates and bis-dithiocarbamates were synthesized and tested for corrosion resistance, antiwear, and antigalling properties. The compounds were prepared by reacting 2,4,6-trimethyl-1,3-bis(chloromethyl)benzene with alkaline salts of xanthogenic and dithiocarbamic acids in the presence of isopropyl alcohol as a solvent. The structures of the products were confirmed by IR and PMR spectroscopy. When added to M-11 lube oil, the compounds exhibited effective corrosion resistance and anti-wear properties. References 3 (Russian).

UDC 665.7.038.5

**Stabilization of Jet Fuel T-6 With Inhibitor S-789 and Compositions Thereof**

18410138g Moscow *KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL in Russian No 2, Feb 89 pp 21-22*

[Article by T. P. Vishnyakova, I. A. Golubeva, L. P. Gutnikova, L. A. Skripko, and V. L. Trostyanetskaya, Petroleum and Gas Industry Institute imeni I. M. Gubkin, Moscow; Chemical Polymer SRI]

[Abstract] Jet fuels prepared by hydrogenation refining have a high tendency to oxidize during storage owing to the lack of heterocyclic compounds. During service, hydroperoxides accumulate and destroy rubber components in the fuel system. With the greater velocities and longer flights associated with further advances in aviation technology comes the problem of insoluble residues and resin formation in hydrogenated fuels that disrupt normal operation of jet engines. This may be overcome by developing antioxidant additives effective over a wide range of temperatures. Aromatic amines are effective stabilizers for this

purpose, and they manifest a synergistic effect when used in conjunction with phenolic antioxidants. A study was made of the inhibiting activity of aromatic amine S-789, recommended as a synthetic rubber stabilizer, and compositions of it with phenolic antioxidants. The effectiveness of the inhibitor was tested by 12-fold heating at 120°C and oxidation in a closed container at 180°C. The inhibitor S-789 suppresses oxidation in T-6 jet fuel more effectively than do the phenolic antioxidant ionol and Mannich bases OMI and NG 22-46 used alone. Used in a 2:1 ratio with phenolic antioxidant, S-789 is more effective than ionol or other known antioxidants are. From a technological standpoint, the two-component inhibitor must be used as a xylene solution in which residues are formed upon prolonged storage. This may be overcome by adding epoxides and phosphites. Figures 2; references 7 (Russian).

UDC 665.63.033.28

**Increasing Stability of High Viscosity Marine Fuels Derived From Residual Fractions**  
18410138h Moscow *KHIMIYA I TEKHOLOGIYA*  
*TOPLIV I MASEL in Russian No 2, Feb 89 pp 22-24*

[Article by N. K. Kondrasheva and Ye. A. Maslovskaya, Ufa Petroleum Institute; Petroleum and Gas Industry Institute imeni I. M. Gubkin, Moscow]

[Abstract] One form of rational utilization of oil stocks, particularly in marine transportation, consists of combining heavy residual fuels for medium- and low-rpm marine diesels and developing a new high-viscosity marine fuel. According to modern colloid chemical theory, petroleum residues may be considered complex structural units (SSE) dispersed in a liquid dispersion medium. The hypomolecular structures of high-molecular compounds such as asphaltenes and solid paraffins become nuclei surrounded with surface layers of low-molecular compounds. Any colloid chemical conversions in petroleum dispersed systems (NDS), which ultimately determine the properties of the petroleum product, are affected by variations in size and concentration of the SSE. Therefore, by regulating the dispersion and submicrostructure of an NDS with various modifiers it becomes possible to control such properties as structural-mechanical rigidity and pour point. Hence, in selecting the components of a high-viscosity marine fuel, in addition to checking operational features, an attempt should also be made to study the colloidal structures of various fuel compositions and determine the dimensions of the structural units contained therein by low-angle x-ray diffraction. This technique was employed in the present work to gather data on heavy residues of atmospheric-vacuum distillation of mixtures of West Siberian high sulfur crudes (bottoms) and bottoms thermal cracking residues. A straight-run diesel fraction and a kerosene-gas oil fraction were used as the second fuel component. A direct relationship exists between the extreme changes in number and size of SSE

and important service characteristics of the fuel. These data could be used to develop optimum compositions for marine fuels. Figures 4; references 13: 12 Russian, 1 Western.

UDC 665.61[470.6

**Crude Oil of Praskoveysk Deposit of Stravropolskiy Kray**  
18410138j Moscow *KHIMIYA I TEKHOLOGIYA*  
*TOPLIV I MASEL in Russian No 2, Feb 89 pp 26-28*

[Article by V. A. Dorogochinskaya, E. D. Shulzhenko, V. P. Varshaver, R. K. Khabibulina, L. R. Kochuleva, and G. V. Kapitonova, Grozniy SRI]

[Abstract] The new Praskoveysk oil deposit is located in the western part of the Prikumsk oil and gas region and is confined to the southwestern part of the Praskoveysk-Achikulaksk structural zone. Ten test wells were bored, and in the present work some results are presented on the unified Program No 1 study of crudes from well No 102 (Upper Cretaceous sedimentation). The crudes are characterized by a 861.8 kg/m<sup>3</sup> density at 20°C, a viscosity of 10.63 mm<sup>2</sup>/s at 20°C, a pour point of 14°C, and a flash point of 24°C. They contained the following (percent by weight): silica gel resins, 8.23; asphaltenes, 1.88; waxes, 2.2; sulfur, 0.64; nitrogen, 0.196; mechanical impurities, 0.01; and chlorides. They also had the following parameters: 31.2 mg NaCl/L; acid number, 0.195 mg KOH/g; and 3.66% coking. The metal content was as follows (μg/L): vanadium, 15; nickel, 6; iron, 3; and sodium, 0.2. The crude contains a significant quantity of low-octane gasoline fractions high in cyclane content and low in sulfur and acidity, and there is no nitrogen in the gasoline fractions, which makes them high-quality feedstock for catalytic reforming. The jet fuel fraction has a low crystallization initiation temperature, a low viscosity, and low sulfur and arene contents, but a high acidity. After alkaline refining, it may be used for the jet fuels TS-1 and TS-2 in accordance with GOST 10227-86. Kerosene and diesel fractions comply with GOST standards, and the bottoms stock is suitable for road asphalt production.

UDC 621.892

**Effect of Lubrication on Efficiency of Noble Metal Sliding Contacts**  
18410138k Moscow *KHIMIYA I TEKHOLOGIYA*  
*TOPLIV I MASEL in Russian No 2, Feb 89 pp 41-42*

[Article by N. I. Tikhonova, V. A. Glazachev, L. D. Sokut, and I. G. Fuks, Simferopol Branch Dnepropetrovsk Engineering-Construction Institute; Petroleum and Gas Industry Institute imeni I. M. Gubkin, Moscow]

[Abstract] Lubricant greases are used to increase the reliability of sliding contact switches that are used to transmit electrical signals between the interacting components of various devices. The criteria used to judge the

service characteristics of sliding contact switches are the electrical resistance  $R$  of the contact, voltage drop  $U$  at the contact point, and coefficient of friction  $\mu$ . The lubricant helps maintain the electrical contact, reduces the force due to friction, and raises the resistance somewhat. A surfactant present in the lubricant causes mastication (breakdown) of the contact surfaces. A study was made of the possibility of controlling this breakdown process by varying the content of lubricant, and therefore the surfactant, in the solvent. This method of altering the surfactant content per unit of contact surface preserves the effects of other components of the lubricant on the sliding contact, particularly prevention of film formation. An experimental setup was developed with which it was possible to make simultaneous measurements of  $\mu$  and  $U$  on silver alloy sliding contacts.

Sliding contact characteristics were studied with lithium grease Era applied as a petroleum ether solution in concentrations of 2, 5, 20, and 50%. This grease contains tricresyl phosphate as a surfactant. Tests were conducted on the sliding contacts for 1,500 hours to determine the optimum concentration. Microhardness measurements showed a drop in the degree of sliding contact breakdown with a low-concentration lubricant solution, 5% being optimal. Apparently, during sliding of contact surfaces, a wave of deformed masticated base material forms that results in an increment in the deformational component of the coefficient of friction. Mastication of a sliding contact surface with a lubricant stabilizes and lowers the value of  $U$  by increasing the actual contact area. Figure 1; references 2 (Russian).

UDC 543.253:541.135

**Local Electrochemical Analysis of Products of Zinc and Copper Mutual Diffusion. Determination of Thickness of Zinc Coating Reactive Layer and Uniformity of Brass Diffusion Layer**

18410128a Moscow *ZHURNAL ANALITICHESKOY KHIMII* in Russian Vol 44, No 1, Jan 89 (manuscript received 19 Jun 87) pp 64-67

[Article by V. V. Slepishkin, B. M. Stifarov, and Ye. Ya. Neyman, Kuybyshevskiy Polytechnical Institute, and State Scientific Research and Design Institute of the Dye and Varnish Industry, Moscow]

[Abstract] Local electrochemical analysis was used to study zinc coatings deposited on copper foil. An NaCl solution was found to be the most suitable background electrolyte. Due to the differences in the rates and potentials of zinc and copper dissolution, express coulometric analysis of zinc layer thickness in the thermodiffusion coating was possible. The first portion of the polarization curve corresponded to zinc layer dissolution, while the remainder represented dissolution of brass in the diffusion layer. Long-term storage of zinc coatings caused the atomic diffusion front to become distributed over a significant depth. Comparison of polarization curves obtained from zinc coatings with those from various brass standards indicated that the  $\gamma$ -phase was the most extensive, more than four times thicker than the  $\epsilon$ -phase.  $\beta$ -Brass was practically absent. Gradual transitions from the  $\epsilon$ - and  $\gamma$ -phases to  $\alpha$ -brass were noted. Figures 2; references 8: 7 Russian, 1 Western.

UDC 678-13:547.339.211:547.538.141.01.029.5:699:539.612

**Adhesion Interaction During Chemical Metallization of ABS-Plastics**

18410142e Moscow *PLASTICHESKIYE MASSY* in Russian No 2, Feb 89 pp 52-56

[Article by A. B. Zilberman, B. S. Fridman, M. S. Guseva, M. A. Yefimov, and V. Ye. Arkhireyev]

[Abstract] Metallized plastics are low in density and require simple methods of fabrication to give products having metallic properties such as electrical conductivity and high surface hardness. Applications include machine building and electronics. Over 90% of all metallized polymers are ABS-plastics (acrylonitrile-butadiene-styrene copolymers) because they adhere strongly to metals. A major drawback in the technology of producing these products by chemical-galvanic metallization lies in the need to employ noble metals during the activation process. Palladium ions, desorbed from the dielectric surface, lower the stability of the working solution and tend to increase the porosity of the coating, which results in the low corrosion resistance of the latter. Activation may also be achieved without noble metal ions by using a stable colloidal system containing copper and nickel salts, sucrose (as a complexing agent), and alkali. The

high catalytic activity of the solution is due to the presence of nickel and copper hydroxides and the copper-sucrose complex. The activation process without palladium consists of treating the pickled surface of the polymer in the activating solution and reducing with a strong reducing agent ( $\text{KBH}_4$ ) where the adsorbed copper and nickel ions are reduced to a lower valency state to provide catalytically active sites for subsequent chemical metallization. The adhesion interaction of such systems has not been studied. It has been assumed the strength of such adhesion joints is determined by the breakdown of anchor linkages formed between the chemically precipitated metal and the polymer surface with no physicochemical interaction. In this case the adhesion strength is determined solely by the cohesion characteristics of the polymer surface layer. However, this is refuted by experimental data demonstrating that both the mean radius and quantity of microheterogeneities on an ABS-plastic surface remain almost constant during pickling while the adhesion strength of the joint varies. These results suggest that chemical reaction at the polymer-metal interface has an effect on the strength of the adhesion bond. Experiments were conducted where ABS-plastic samples were coated by using both methods, and the chemical nature of the surface layers was studied by x-ray photoelectron spectroscopy. The data show that the ratio of carbon-to-nitrogen bonds decreases from 22.2:1 to 17.3:1 during the pickling process due to selective pickling of the elastomer component of the polymer composition. This provides specifically shaped spaces for subsequent chemical precipitation of the metal to form anchor linkages with the substrate. Interfacial analysis revealed the presence of a significant quantity of carbon atoms on the metal surface, which makes it possible to conclude that a breakdown occurs in the transitional layer of the polymer. Regardless of the method of activation, interfacial interaction at the polymer-metal interface is due to the formation of copper alcoholates. References 20: 9 Russian, 11 Western.

UDC 678.762.2-135.475.381.41.01:66.085.3

**Effect of Ionizing Radiation on Mechanical Properties of Butadiene-Styrene Thermoelastic Plastic DST-30**

18410142a Moscow *PLASTICHESKIYE MASSY* in Russian No 2, Feb 89 pp 19-31

[Article by A. A. Zevin, T. V. Artamonova, T. B. Agatova, and V. S. Tikhomirov]

[Abstract] Thermoelastic plastics (TEP) are widely used industrially; however, their relatively low heat resistance precludes even wider usage. Triple-blocked butadiene-styrene TEPs in which an elastic polybutadiene block is sandwiched between two rigid polystyrene blocks are the most widely used. Their structure is dependent on the composition and method of preparation, and although they have been well studied, information is still lacking on the effects of high-energy radiation on them. In the present work a study was made of the resistance of

DST-30, a triple-blocked butadiene-styrene copolymer containing 30% polystyrene. The molecular weight of the polybutadiene block was 70,000, and that of the polystyrene block was 15,000. Rectangular samples were evacuated and sealed in glass ampules and irradiated with a gamma-source at doses varying from 0 to 5.0 MGy. Tests for tensile strength to breaking, elasticity modulus, and relative elongation showed that the mechanical properties and radiation resistance are functions of both the structure and conditions under which the samples were prepared, i.e., from a chloroform solution or by compression. The heat resistance of DST-30 may be increased by radiation at relatively low dosages with no loss in tensile strength or elasticity. Figures 3; references 8: 4 Russian, 4 Western.

UDC 678.84:66.018.4:667.777

**Health Hygiene Studies of Properties of Heat-Resistant Food-Grade Composite Materials**  
18410142b Moscow PLASTICHESKIYE MASSY  
in Russian No 2, Feb 89 pp 21-23

[Article by G. A. Petrova, L. A. Moshlakova, B. G. Zavin, L. V. Pyatigorskaya, and L. A. Sukhareva]

[Abstract] Polyphenylsilsesquioxane and polydimethylsiloxane block copolymers have a higher heat resistance than do linear polydimethylsiloxane, which makes it possible to use the former in contact with food products at temperatures to 350°C. Thermogravimetric analysis is not suitable for making hygienic evaluations of block copolymers at high temperatures. Decomposition products, known to be formed at high temperatures through the rupture of certain molecular and surface bonds, are released into the gaseous phase. Also, thermal oxidation of silicon-organic polymers results in the formation of toxic compounds, phenol, and formaldehyde. A chromatographic technique developed at the Hygiene SRI imeni F.F. Erisman, Moscow, was used to test the block copolymers Bloksil 2005 and 2010, stabilized with polyphenylferrosiloxane and copper bis-diethyldithiophosphate, respectively. The tests showed that at 300-400°C, formaldehyde is chiefly released. The amount of phenol is below the maximum permissible level. Bloksil 2005 may thus be used for bread-baking purposes. Figures 2; references 5 (Russian).

UDC 678.073.033.01.539.3

**Deformation-Strength Properties of Filled Thermoplastic Mixtures**  
18410142c Moscow PLASTICHESKIYE MASSY  
in Russian No 2, Feb 89 pp 34-37

[Article by A. Ye. Zaikin, Ye. A. Kharitonov, and Ye. V. Kuznetsov]

[Abstract] Although the applications of polymer compositions having a hybrid binder are increasing, their structure and properties have not yet been fully studied.

Finely divided fillers such as carbon black or aerosil could be unevenly distributed between the polymer components in heterogeneous mixtures, and since the properties of these polymers change in different ways after filling, it may be assumed that the nature of filler distribution among the components of a polymer mix will have an effect on its overall properties. In the present work a study was made of the effect of filler distribution on the deformation-strength characteristics of some filled polymer-polymer compositions. High- and low-pressure polyethylenes were used in conjunction with urethane thermoplastic, isoprenestyrene thermoplastic, polyisobutylene, and synthetic nitrile rubber (SKN-26) as elastomers; technical-grade carbon blacks PME-100V and PM-15 and aerosil A-175 were used as fillers. The compositions were prepared in heated rolling mills. Comparisons were made of tensile strength and relative elongation of the compositions in which the filler was localized in the polyethylene phase with those in which the filler was in the second component of the mixture. The study showed that heterogeneous mixtures of such thermoplastics fall into two groups. The first group includes polymers having low adhesion to one another. If one component of such a mix should have a greater adhesion to the filler surface than to the other component, then the deformation-strength properties of the mix will increase if the filler is localized in the polymer phase. The second group includes polymers having sufficiently high adhesion to one another, and their properties are determined by the degree of change in properties of each polymer. Those mixtures in which the filler is localized in the polymer have the highest deformation-strength properties. References 8: 6 Russian, 2 Western.

UDC 678.027.74:677.8

**Low-Pressure Molding of Plastisols With Impregnation of Matrix Elements**  
18410142d Moscow PLASTICHESKIYE MASSY  
in Russian No 2, Feb 89 pp 43-47

[Article by M. L. Fridman, A. Z. Petrosyan, and G. R. Mkrtchyan]

[Abstract] High-quality components with intricate configurations may be fabricated from low-viscosity polymer systems such as epoxy-acrylate compositions, polymer pastes, or thermoplastics with low energy costs and relatively simple instrumentation. Furthermore, thermomechanical breakdown of the polymer is almost entirely prevented in the case of low-pressure molding. In the past plastisol products were shaped either by dipping, free casting in molds, or atomization. This has now been chiefly replaced by low-pressure (0.1-1.0 MPa) casting into closed molds through ingress ducts. While the technology for traditional methods of plastisol fabrication have been well described, the theoretical analysis and mathematical modeling of the processes are not yet complete. In the present work an analysis was made of the process technology involved in filling out molds

while simultaneously impregnating a fabric element, such as that employed in fabricating reinforced plastisol products. References 11 (Russian).



UDC 541.141.7:547.636:547.571

**Photolysis of Desoxybenzoins in Micelles,  
Chemical Yield of Benzaldehyde and Magnetic  
Isotope Effect**

18410139d Moscow IZVESTIYA AKADEMII NAUK  
SSSR: SERIYA KHIMICHESKAYA in Russian  
No 2, Feb 89 (manuscript received  
30 Sep 87) pp 264-268

[Article by V. F. Tarasov, Ye. N. Step, L. A. Margulis,  
and A. L. Buchachenko, Physical Chemistry Institute,  
Moscow]

[Abstract] Due to the magnetic isotopic effect, photolysis of desoxybenzoins results in a separation of  $C^{12}$  and  $C^{13}$  isotopes. The coefficient of separation efficiency,  $\alpha$ , is inversely proportional to the chemical yield of benzaldehyde,  $X$ , one of the reaction products. Evidently, benza-

ldehyde is a disproportionation reaction product of geminal radical pairs formed during the photolysis, i.e. a nonreversible reaction competes with a reversible reaction. The more the disproportionation competes with radical pair recombination, the less the efficiency of isotope separation. However, it is still not clear whether the radical pair disproportionation reaction has the same degree of selectivity toward the presence of  $C^{13}$  as that of the recombination reaction. In the present work it was demonstrated that the radical pair disproportionation reaction has the same degree of magnetic and isotope selectivity as that of the recombination reaction, and therefore an increase disproportionation yield,  $X$ , results in a drop in  $\alpha$ . During photolysis of these compounds, the efficiency of  $C^{12}$  and  $C^{13}$  separation, as measured by the magnetic isotope effect, decreases due to an increase in the probability of isotope-selective disproportionation of radical pairs. Figures 3; references 11: 5 Russian, 6 Western.

UDC 542.91:547.455

**Synthesis of Macrolide Antibiotics. Report 14.**  
**Synthesis of 1- Methylene-3,5-O-**  
**isopropylidene-9,11-O-p-(methoxybenzylidene)-**  
**9(S)- dihydro-Derivative of**  
**9(S)-Dihydroerythronolide B Seco-Acid**  
18410139f Moscow IZVESTIYA AKADEMII NAUK  
SSSR: SERIYA KHIMICHESKAYA in Russian  
No 2, Feb 89 (manuscript received  
10 Aug 87) pp 438-447

[Article by A. F. Sviridov, M. S. Yermolenko, D. V. Yashunskiy, V. S. Borodkin, and N. K. Kochetkov, Organic Chemistry Institute imeni N. D. Zelinskiy, Moscow]

[Abstract] Previous work showed that a planned co-linking of C<sup>1</sup>-C<sup>8</sup> and C<sup>9</sup>-C<sup>13</sup>-groups to form erythronolide B precursor by stereo-directed synthesis was unsuccessful owing to the impossibility of building the correct C<sup>8</sup>, C<sup>9</sup> stereochemistry. In the present work the title compound was synthesized by employing an alternate method based on co-linking C<sup>1</sup>-C<sup>6</sup> with C<sup>7</sup>-C<sup>13</sup>.

UDC 542.91:547.455

**Synthesis of Macrolide Antibiotics. Report 15.**  
**Stereo-Directed Synthesis of Erythronolide B By**  
**Co-linkage of (C<sup>9</sup>-C<sup>13</sup>) + (C<sup>7</sup>-C<sup>8</sup>) + (C<sup>1</sup>-C<sup>6</sup>)**  
**Groups**  
18410139g Moscow IZVESTIYA AKADEMII NAUK  
SSSR: SERIYA KHIMICHESKAYA in Russian  
No 2, Feb 89 (manuscript received  
10 Aug 87) pp 447-451

[Article by A. F. Sviridov, M. S. Yermolenko, D. V. Yashunskiy, V. S. Borodkin, and N. K. Kochetkov, Organic Chemistry Institute imeni N. D. Zelinskiy, Moscow]

[Abstract] A stereo-directed synthesis of 9(S)- dihydroerythronolide B seco-acid precursor (I) was described in a previous report of this series (see Report 14). The configuration of 9 of the 11 chiral sites in (I) C<sup>2</sup>-C<sup>5</sup> and C<sup>9</sup>-C<sup>13</sup> has been rigorously proved with PMR spectra of a number of cyclic derivatives. A comparison of compound (I) with a product having the same structure prepared by an alternate method and having a known configuration of C<sup>6</sup> and C<sup>8</sup> sites proved to be identical and therefore in full stereochemical congruency with 9(S)-dihydroerythronolide B. The seco- acid, which may be prepared from derivative (I), meets all requirements for successfully completing the macrolactonization stage, viz., the (S)- configuration of the C<sup>9</sup> site, the presence of 3,5- and 9,11- bis(cyclo)acetal system, and the equatorial positioning of the p- methoxyphenyl group at the 9,11-acetal site. This made it possible in the present work to enter the final stage of complete stereochemically directed synthesis of erythronolide B from carbohydrates by co-linkage of (C<sup>9</sup>-C<sup>13</sup>) and C<sup>7</sup>-C<sup>8</sup>) + (C<sup>1</sup>-C<sup>6</sup> groups, i.e.

macrolactonization and direct aglycon comparison of synthetic with natural antibiotics and their derivatives. References 13: 2 Russian, 11 Western.

UDC 541.64

**Foam-Forming Properties of Concentrated Albumin**  
**Solutions as Blood Plasma Simulators**  
18410140d Moscow ZHURNAL FIZICHESKOY  
KHIMII in Russian Vol 63 No 2, Feb 89 (manuscript  
received 19 Nov 87) pp 454-458

[Article by M. A. Khachatryan, V. N. Zakharchenko, and F. F. Karpov, No 2 Moscow State Medical Institute imeni N. I. Pirogova]

[Abstract] The study of albumin-containing simulators is important for the development of such physicochemical methods as air percolation of blood plasma to detoxify it and mixtures containing plasma substitutes. In the present work a study was made of some of the properties of foams resulting from solutions containing 0.75-3% serum albumin. Nonionogenic components included polyvinyl pyrrolidone and partially hydrolyzed dextran buffered to pH 7.5 with phosphate. Foams were obtained by air percolation at constant pressure through a porous glass filter into a cylinder with a fixed height. The results demonstrate that it is possible to simulate biological plasma-containing substitutes by adding dextran or polyvinyl pyrrolidone to albumin solutions. Figures 3; references 7: 6 Russian, 1 Western.

UDC 541.124

**Free Radical Oxidation of Hydrocarbons and**  
**Problem of Environmental Protection**  
18410140e Moscow ZHURNAL FIZICHESKOY  
KHIMII in Russian Vol 63 No 2, Feb 89 (manuscript  
received 4 May 88) pp 467-470

[Article by M. A. Babizhayev, Eye Disease SRI imeni Gel'mholts, Moscow]

[Abstract] Moscow city air samples and exhaust pipe deposits of a Volga-GAZ-24 were analyzed on a Shimadzu UV-260 spectrophotometer to study the mechanism of formation of smog components. It was demonstrated that smog components begin to form in the atmosphere when volatile hydrocarbons resulting from incomplete combustion by vehicular traffic undergo free radical oxidation in the presence of oxides of nitrogen. It is suggested that this could be lessened to a certain extent through use of antioxidant additives. Figure 1; references 11: 3 Russian, 8 Western.

UDC 536.42

**Self-Generated Vibrations and Waves in Models of Interfacial Boring Rig Oscillator**

18410140f Moscow *ZHURNAL FIZICHESKOY KHIMII* in Russian Vol 63 No 2, Feb 89 (manuscript received 27 Jan 88) pp 483-486

[Article by A. N. Zaikin, Biological Physics Institute, Pushchino]

[Abstract] A mathematical model of periodic crystallization and melting at the surface layer of a system maintained at isothermal conditions near the freezing point is presented. The phenomenon represented by the model may be visualized as a vessel containing a dilute solution of ammonia or alcohol that is maintained isothermally near the solution's freezing point in such a way that forward and reverse first-order phase transition waves moving into the depths of the solution and along its surface may be observed and recorded. Periodic processes in active systems may be represented by the solution of model equations of partial derivatives whose

derivatives have no set points or quasistationary characteristics and frequently cannot be realized physically. Such systems can acquire a physical sense by the addition of diffusion terms and first-order boundary conditions. In this case the derivative system models only component interaction, while the diffusion terms organize the relation between points in space, diffusion emigration of products of interaction, and diffusion importation of required resources. This model is represented by a partial differential equation solved with a computer for two intervals. The results show that the crystallization front may displace any impurity (not only the one supporting self-oscillation) both laterally and from the surface to the depths. This impurity may be concentrated in the depth if its coefficient of diffusion is low enough. This is significant for an understanding of the mechanisms underlying certain chemical and biological processes. An expanded model that includes a source of electrical potential at a mobile phase interface could be useful in explaining the nature of active ion transport in biological membranes. Figures 2; references 5: 4 Russian, 1 Western.

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